WE CLAIM:

1. A process for making a linear alpha-olefin oligomer in a reactor comprising a liquid and a gas phase, comprising the steps of catalytically oligomerizing ethylene in the presence of an iron complex of a 2,6-bis(arylimino)pyridine derivative, to an alpha-olefin oligomer under release of heat, and removing the heat with a heat exchanger which is not in direct contact with the liquid phase, using at least part of the gas phase as a coolant medium.

2. The process of claim 1 wherein an aluminum-based co-catalyst is added to the liquid phase.

3. The process of claim 2 wherein the aluminum-based co-catalyst is an aluminoxane selected from the group consisting of methyl aluminoxane, alkyl-modified methyl aluminoxane, and mixtures thereof.

4. The process of claim 3 wherein the aluminum-based co-catalyst is a methyl aluminoxane.

5. The process of claim 1 wherein the oligomer is an alpha-olefin oligomer with an average molecular weight between about 50 and about 350.

6. The process of claim 5 wherein the average molecular weight is between about 60 and about 280.

7. The process of claim 6 wherein the average molecular weight is between about 80 and about 210.

8. The process of claim 2 to which is added a second co-catalyst compound which comprises one or more compounds of the formula ZnR'_2 wherein each R', which may be the same or different, is selected from hydrogen, optionally substituted C_1-C_{20} hydrocarbyl, phenyl, F, Cl, Br, I, SR'', NR''_2, OH, OR'', CN, NC wherein R'', which within the same molecule may the same or different, is C_1-C_{20} hydrocarbyl.

9. The process of claim 8 wherein R' is C_1-C_{20} hydrocarbyl.

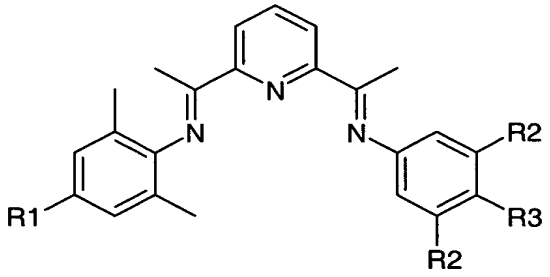
10. The process of claim 9 wherein R' is C_1-C_{20} alkyl.

11. The process of claim 10 wherein R' is C_1-C_6 alkyl.

12. The process of claim 11 wherein R' is ethyl.

13. The process of claim 1 wherein one of the aryl moieties of the 2,6-bis(arylimino)pyridine derivative is 2,6-disubstituted with the group CH_2R or C_2H_5R, wherein R is selected from H and F, and the other aryl moiety is 2,6-unsubstituted, or wherein both aryl moieties of the 2,6-bis(arylimino)pyridine derivative are 2,6-disubstituted with F or Cl.

14. The process of claim 1 wherein the 2,6-bis(arylimino)pyridine derivative has the formula:

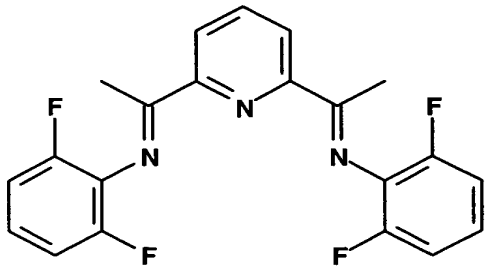


wherein

R1 is H or CH_3;

R2 is H, tert-butyl or phenyl and

R3 is H, tert-butyl or OR' wherein R' stands for CH_3, $Si(CH_3)_3$ or eicosyl ($C_{20}H_{41}$); or



15. The process of claim 1 wherein the coolant medium is selected from the group consisting of an alkane, an alkene, and an aromatic compound, and mixtures thereof.
16. The process of claim 1 wherein the coolant medium is selected from the group consisting of propane, n-pentane, isopentane, ethylene, 1-butene, o-, m-, and p-xylene, and toluene, and mixtures thereof.
17. An apparatus for performing the process of making linear alpha-olefin oligomer of claim 1 comprising a reactor which can accommodate a liquid phase and a gas phase, an inlet through which the reactor feed is introduced into the reactor, a reactor bottom outlet through which the oligomer is removed, a heat exchanger which is positioned in the gas phase to condense the gas and allow the condensate to fall therefrom to cool the liquid phase thereby cooling the liquid, and optionally, a gas outlet and/or an entrainment separator.
18. The apparatus of claim 17 wherein a gas entrainment separator which is positioned in the gas phase.
19. An apparatus for performing the process of making linear alpha-olefin oligomer of claim 1 comprising 1) a reactor which can accommodate a liquid phase and a gas phase, a reactor feed inlet, a gas outlet, and a reactor bottom outlet for the reaction products, 2) a heat exchanger which is positioned outside of the reactor, receives gas from the reactor gas outlet, and cools the gas, wherein said gas flows from the heat exchanger through a first gas conduit where part of the gas condenses, 3) a gas-liquid separator which has a gas outlet and a liquid outlet, receives gas and liquid from the heat exchanger, and separates gas, which exits the separator through a second gas conduit and is recycled to the reactor, from liquid, which exits the separator through a liquid conduit and is recycled to the reactor.

20. The apparatus of claim 19 further comprising a compressor between the heat exchanger and the gas-liquid separator.

21. The apparatus of claim 20 further comprising a pump in the liquid conduit.

22. The apparatus of claim 20 further comprising a compressor and/or a heat exchanger in the second gas conduit.

23. The apparatus of claim 20 further comprising an entrainment separator in the reactor in the gas phase.

24. An apparatus for performing the process of making linear alpha-olefin oligomer of claim 1 comprising 1) a reactor which can accommodate a liquid phase and a gas phase, a reactor feed inlet, a gas outlet, and a reactor bottom outlet for the reaction products, and 2) a heat exchanger which is positioned outside of the reactor, receives gas from the reactor gas outlet, and cools the gas, wherein said gas flows from the heat exchanger through a gas conduit and is recycled to the reactor.

25. The apparatus of claim 15 further comprising a compressor and/or a heat exchanger in the gas conduit.